US009334603B2

(12) **United States Patent**
Oak et al.

(10) **Patent No.: US 9,334,603 B2**
(45) **Date of Patent: May 10, 2016**

(54) **CLOTHING DRYER AND CONTROL METHOD THEREOF**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 63 days.

(21) Appl. No.: **14/244,335**

(22) Filed: **Apr. 3, 2014**

(65) **Prior Publication Data**

US 2014/0298676 A1 Oct. 9, 2014

(30) **Foreign Application Priority Data**

Apr. 3, 2013 (KR) 10-2013-0036347

(51) **Int. Cl.**
D06F 58/20 (2006.01)
D06F 58/28 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***D06F 58/28*** (2013.01); ***D06F 58/04*** (2013.01); ***D06F 58/08*** (2013.01); *D06F 2058/2829* (2013.01); *D06F 2058/2877* (2013.01)

(58) **Field of Classification Search**
CPC F26B 11/00; F26B 11/06; F26B 21/00; D06F 58/00; D06F 58/06; D06F 58/20
USPC .... 34/507, 595, 610; 68/5 C, 5 R, 19, 20; 8/139, 149, 159
See application file for complete search history.

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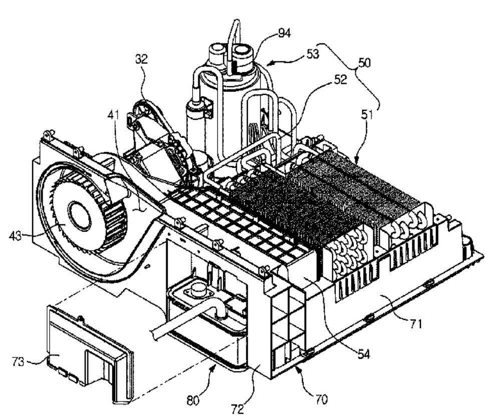
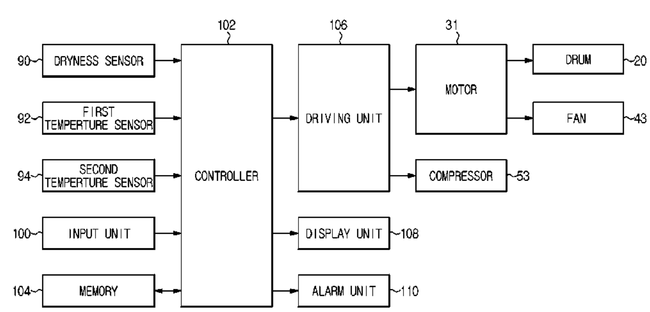
(57) **ABSTRACT**

A clothing dryer and control method thereof is provided. A conventional dryness sensor may be used, without installation of a separate component, to detect breakage of a belt. Upon detection of belt breakage, the motor is stopped together with report of abnormality of the to reduce cost. A conventional temperature sensor may be used to maintain a proper surface temperature of a door of the clothing dryer, without installation of a separate component. Thereby, harm to a user due to rise in the surface temperature of the door may be prevented, and degradation of drying quality may be prevented. Furthermore, the pipe temperature of a compressor may be used to detect incorrect or broken wiring of the compressor. When incorrect or broken wiring of the compressor is detected, the compress is stopped together with report of to protect the product.

19 Claims, 6 Drawing Sheets





(51) **Int. Cl.**
D06F 58/04 (2006.01)
D06F 58/08 (2006.01)

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FIG. 1

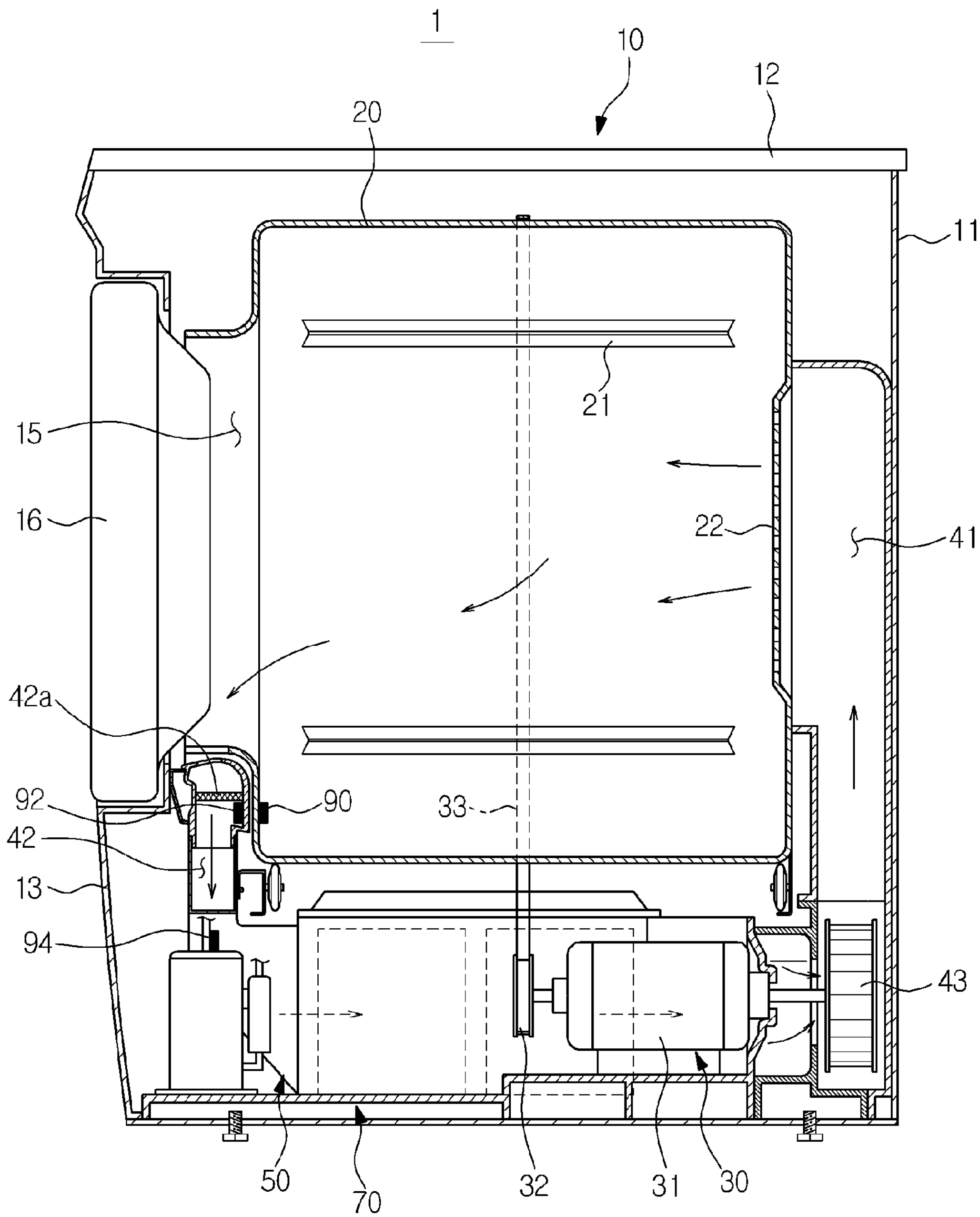


FIG. 2

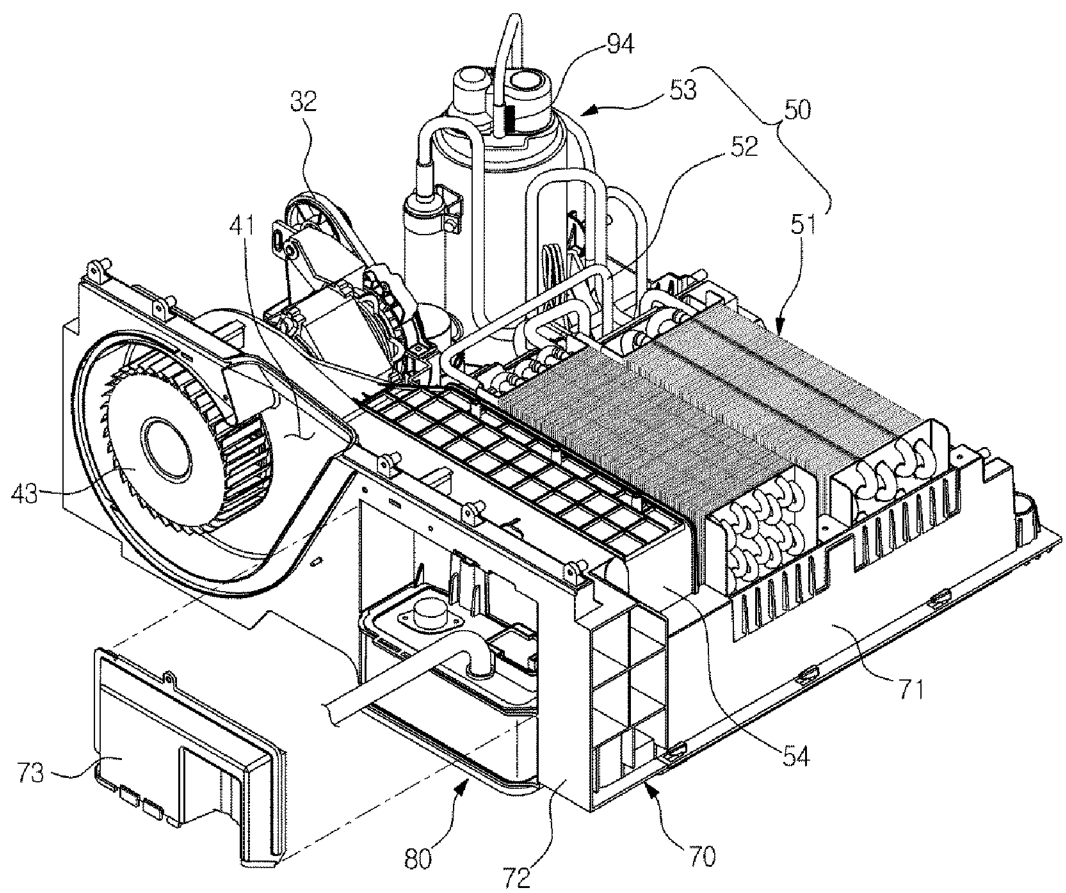
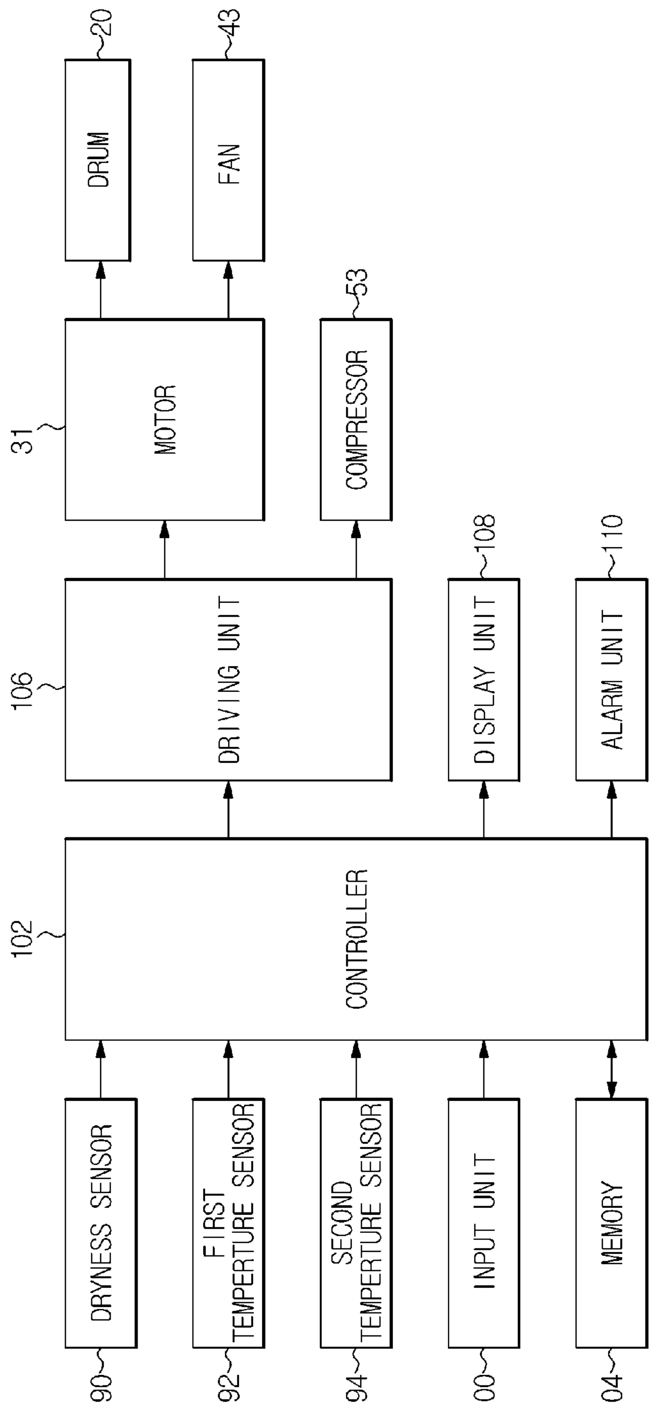


FIG.3



DRYNESS SENSOR
FIRST TEMPERTURE SENSOR
SECOND TEMPERTURE SENSOR
INPUT UNIT
MEMORY
CONTROLLER
DRIVING UNIT
DISPLAY UNIT
ALARM UNIT
MOTOR
COMPRESSOR
DRUM
FAN
90
92
94
100
104
102
106
108
110
31
53
20
43

FIG. 4

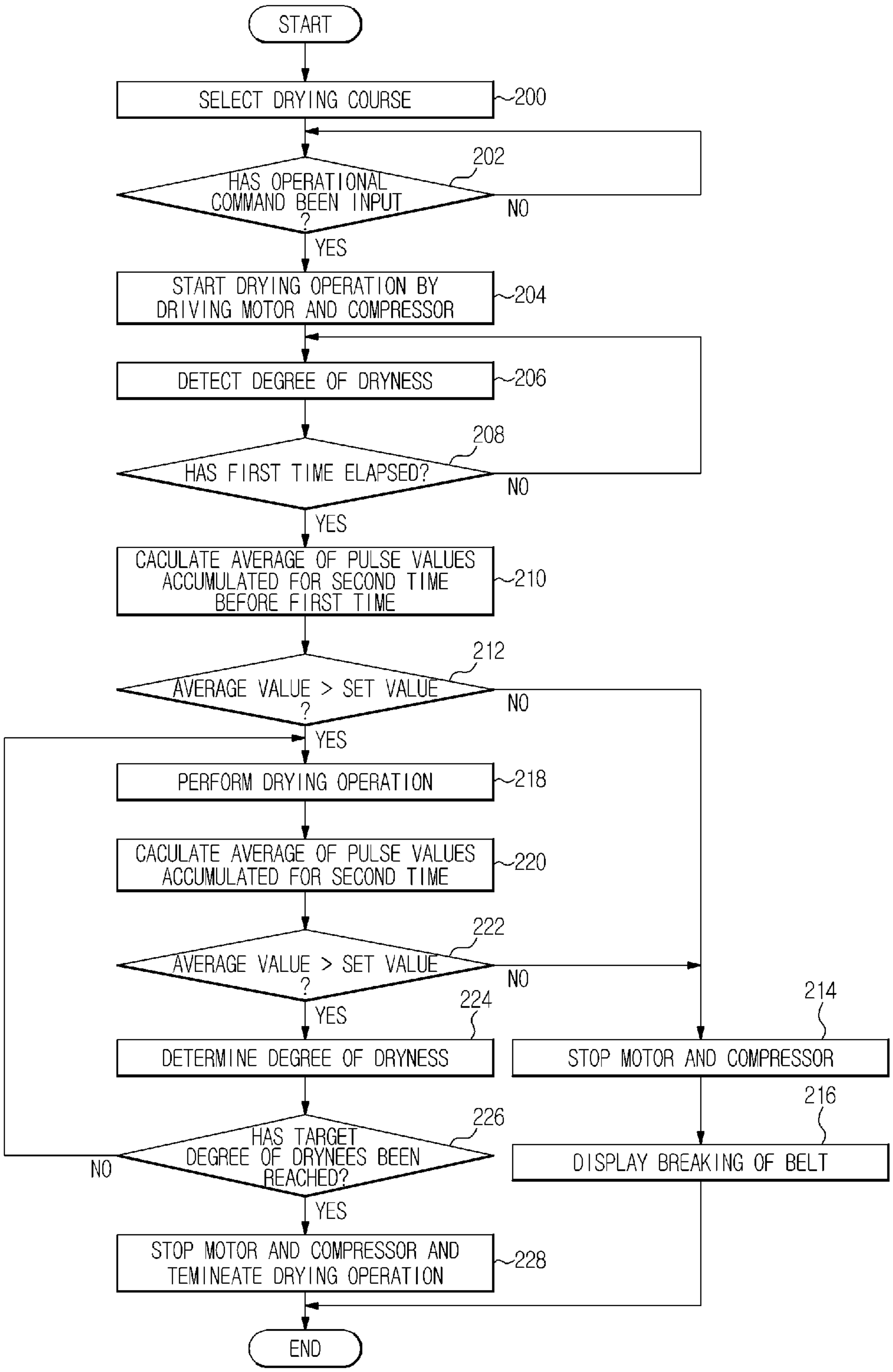

START
SELECT DRYING COURSE
200
HAS OPERATIONAL COMMAND BEEN INPUT ?
202
NO
YES
START DRYING OPERATION BY DRIVING MOTOR AND COMPRESSOR
204
DETECT DEGREE OF DRYNESS
206
HAS FIRST TIME ELAPSED?
208
NO
YES
CACULATE AVERAGE OF PULSE VALUES ACCUMULATED FOR SECOND TIME BEFORE FIRST TIME
210
AVERAGE VALUE > SET VALUE ?
212
NO
YES
PERFORM DRYING OPERATION
218
CACULATE AVERAGE OF PULSE VALUES ACCUMULATED FOR SECOND TIME
220
AVERAGE VALUE > SET VALUE ?
222
NO
YES
DETERMINE DEGREE OF DRYNESS
224
STOP MOTOR AND COMPRESSOR
214
HAS TARGET DEGREE OF DRYNEES BEEN REACHED?
226
NO
YES
DISPLAY BREAKING OF BELT
216
STOP MOTOR AND COMPRESSOR AND TEMINEATE DRYING OPERATION
228
END

FIG. 5

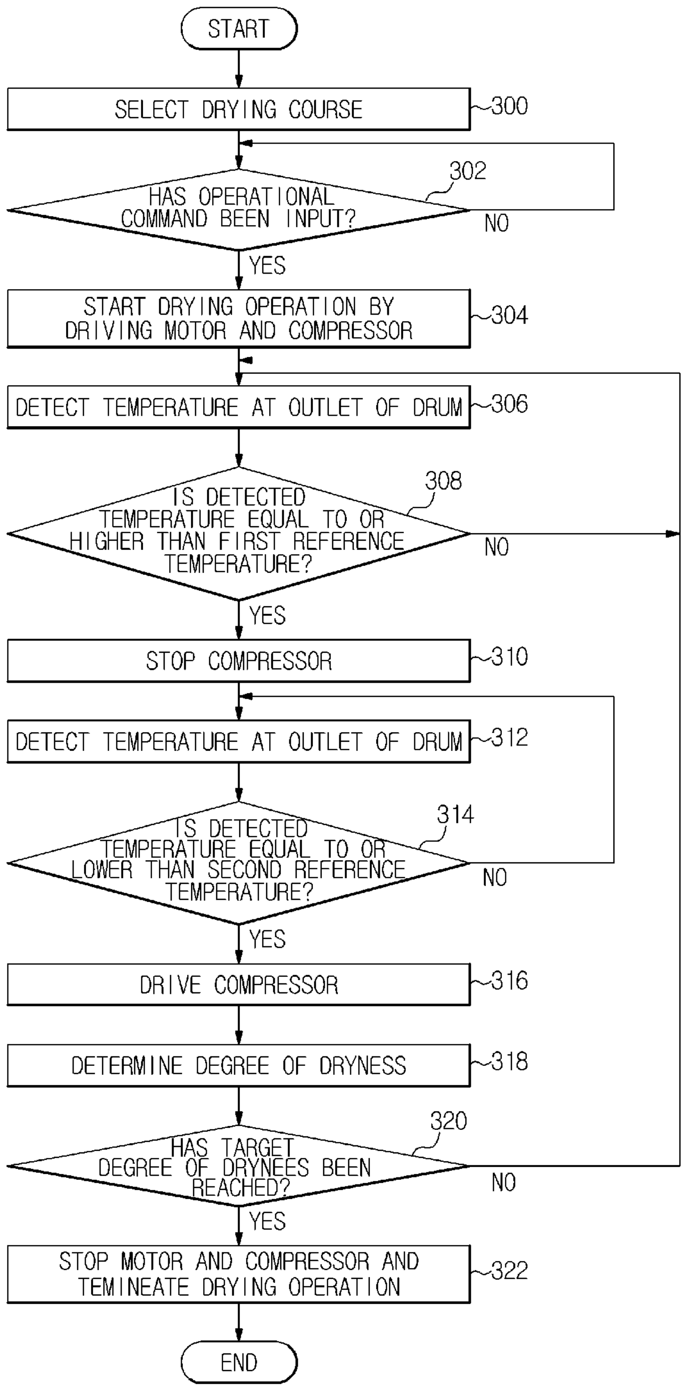
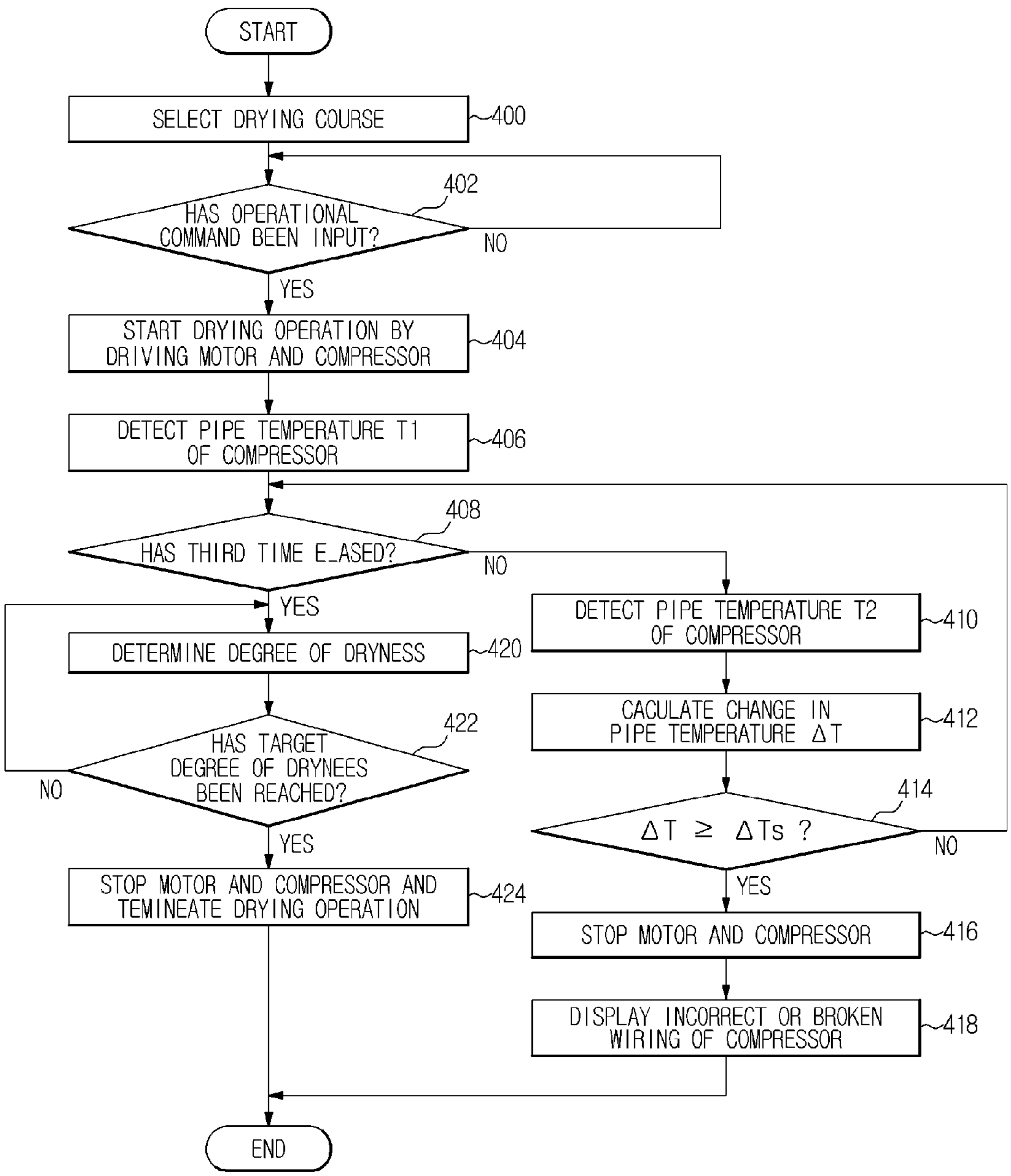

START
SELECT DRYING COURSE
300
HAS OPERATIONAL COMMAND BEEN INPUT?
302
NO
YES
START DRYING OPERATION BY DRIVING MOTOR AND COMPRESSOR
304
DETECT TEMPERATURE AT OUTLET OF DRUM
306
IS DETECTED TEMPERATURE EQUAL TO OR HIGHER THAN FIRST REFERENCE TEMPERATURE?
308
NO
YES
STOP COMPRESSOR
310
DETECT TEMPERATURE AT OUTLET OF DRUM
312
IS DETECTED TEMPERATURE EQUAL TO OR LOWER THAN SECOND REFERENCE TEMPERATURE?
314
NO
YES
DRIVE COMPRESSOR
316
DETERMINE DEGREE OF DRYNESS
318
HAS TARGET DEGREE OF DRYNEES BEEN REACHED?
320
NO
YES
STOP MOTOR AND COMPRESSOR AND TEMINEATE DRYING OPERATION
322
END

FIG. 6


START
SELECT DRYING COURSE
400
HAS OPERATIONAL COMMAND BEEN INPUT?
402
NO
YES
START DRYING OPERATION BY DRIVING MOTOR AND COMPRESSOR
404
DETECT PIPE TEMPERATURE T1 OF COMPRESSOR
406
HAS THIRD TIME E_ASED?
408
NO
YES
DETECT PIPE TEMPERATURE T2 OF COMPRESSOR
410
DETERMINE DEGREE OF DRYNESS
420
CACULATE CHANGE IN PIPE TEMPERATURE ΔT
412
HAS TARGET DEGREE OF DRYNEES BEEN REACHED?
422
NO
YES
ΔT ≥ ΔTs ?
414
NO
YES
STOP MOTOR AND COMPRESSOR AND TEMINEATE DRYING OPERATION
424
STOP MOTOR AND COMPRESSOR
416
DISPLAY INCORRECT OR BROKEN WIRING OF COMPRESSOR
418
END

CLOTHING DRYER AND CONTROL METHOD THEREOF

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the priority benefit of Korean Patent Application No. 10-2013-0036347, filed on Apr. 3, 2013 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND

1. Field

Embodiments relate to a clothing dryer to dry objects such as clothes and a control method thereof.

2. Description of the Related Art

A clothing dryer is an apparatus designed to dry clothes to be dried (hereinafter, referred to as an object to be dried) by supplying high temperature air (hot air) into a drum accommodating the object to be dried while the drum is rotated. The drum slowly rotates about a horizontal shaft, and thereby the objects to be dried is tumbled in the drum and dried without stains. Such a clothing dryer is provided with a fan for circulation of air and a motor to rotate the drum. The fan and drum are rotated at a predetermined rotational speed by a rotating shaft of the motor via a transmission mechanism such as a pulley or a belt. The rotation transmission mechanism at the drum includes a pulley installed at the rotating shaft of the motor, a belt wound around the circumferential surface of the pulley and the cylindrical drum, and a tension member to apply tension to the belt. However, in the case that the belt is broken or displaced, the drum may fail to normally rotate and stop. In this case, hot air is intensively supplied to the objects to be dried which are accumulated near an inlet of the drum through which the hot air is introduced into the drum. Thereby, clothes may be deformed or damaged.

In conventional cases, breakage of the belt is detected by installing a micro switch at one side of the motor which is turned by reaction force produced in the case that the belt is broken. However, detecting breakage of the belt using a mechanical device may necessitate a separate component, resulting in increase in cost and degradation of workability on the assembly line.

SUMMARY

In an aspect of one or more embodiments, there is provided a clothing dryer capable of detecting breakage of a belt using a conventional dryness sensor without having a separate component installed and a control method thereof.

In an aspect of one or more embodiments, there is provided a clothing dryer capable of maintaining a proper surface temperature of the door of the clothing dryer using a conventional temperature sensor and a control method thereof.

In an aspect of one or more embodiments, there is provided a clothing dryer capable of detecting incorrect or broken wiring of a compressor of the clothing dryer and a control method thereof.

In an aspect of one or more embodiments, there is provided a control method of a clothing dryer provided with a drum to accommodate an object to be dried, a motor to generate power to rotate the drum, and a belt to transfer the power of the motor to the drum, includes rotating the drum according to operation of the motor to dry the object to be dried, detecting a degree of dryness of the object to be dried for a specific time and calculating change in the degree of dryness, determining that the belt is abnormal if the calculated change in the degree of dryness is equal to or less than a set value for the specific time, and stopping the motor when determining that the belt is abnormal.

The specific time may be a second time since beginning of a drying operation before the first time elapses.

The specific time may be a second time since beginning of the change in the degree of dryness during a drying operation.

The first time may be about 20 minutes, and the second time may be about 10 minutes.

The control method may further include stopping the motor and at the same time stopping a compressor to compress a refrigerant to heat air flowing into the drum, when determining that the belt is abnormal.

The control method may further includes reporting that the belt is abnormal through an alarm or a visible indication, when determining that the belt is abnormal.

In an aspect of one or more embodiments, there is provided a clothing dryer includes a drum to accommodate an object to be dried, a motor to generate power to rotate the drum, a belt to transfer the power of the motor to the drum, a dryness sensor to detect a degree of dryness of the object to be dried, and a controller to detect change in sensor values of the dryness sensor for a specific time to determine whether the belt is abnormal.

The dryness sensor may output pulse values of the degree of dryness of the object to be dried, the degree of dryness being converted into an electrical signal.

The controller may accumulate deviations of the pulse values input through the dryness sensor for a specific time, and determines that the belt is abnormal when a mean absolute deviation of the accumulated pulse values is equal to or less than a set value.

The controller may stop the motor when the controller determines that the belt is abnormal.

When the controller determines that the belt is abnormal, the controller may stop the motor and at the same time stop a compressor to compress a refrigerant to heat air flowing into the drum.

The clothing dryer may further includes a display unit to display abnormality of the belt or an alarm unit to produce an alarm sound or a buzzer sound, in order to report that the belt is abnormal.

In an aspect of one or more embodiments, there is provided a control method of a clothing dryer provided with a drum to accommodate an object to be dried, a motor to rotate the drum, and a compressor to compress a refrigerant to heat air flowing into the drum, includes performing a drying operation by driving the motor and the compressor, detecting a temperature at an outlet of the drum through a temperature sensor during the drying operation, and comparing the detected temperature at the outlet of the drum with a predetermined reference temperature, and controlling operation of the compressor according to a result of the comparison to keep a surface temperature of a door constant.

The temperature sensor may be a thermistor to detect a temperature of air discharged from the drum.

The thermistor may be installed in a discharge channel allowing the air having passed through the drum to be discharged therethrough.

The controlling of the operation of the compressor may include stopping the compressor when the temperature at the outlet of the drum is equal to or higher than a first reference temperature, and driving the compressor when the temperature at the outlet of the drum is equal to or higher than a second reference temperature.

The motor may be driven regardless of whether or not the compressor is stopped.

In an aspect of one or more embodiments, there is provided a control method of a clothing dryer provided with a door and a drum to accommodate an object to be dried, a motor to rotate the drum, and a compressor to compress and discharge a refrigerant through a pipe to heat air flowing into the drum, the control method including performing a drying operation by driving the motor and the compressor; detecting an initial pipe temperature of the pipe using a temperature sensor installed at a discharge side of the compressor at the beginning of the drying operation; determining whether a predetermined time has elapsed during the drying operation; detecting a current pipe temperature after the predetermined time has elapsed and calculating a difference between the initial pipe temperature and the current pipe temperature; and controlling operation of the motor and compressor according to a result of the calculated difference to protect the clothing dryer from damage due to broken wiring or incorrect wiring of the clothing dryer causing a heat surge and informing the user according to the result by a sound or a visual display.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects of embodiments will become apparent and more readily appreciated from the following description of embodiments, taken in conjunction with the accompanying drawings of which:

FIG. **1** is a perspective view showing the configuration of a clothing dryer according to an embodiment;

FIG. **2** is a detailed view showing the structure of the base of the clothing dryer according to an embodiment;

FIG. **3** is a control block diagram illustrating the clothing dryer according to an embodiment;

FIG. **4** is a flowchart illustrating a control algorithm to detect breakage of a belt in a clothing dryer according to an embodiment;

FIG. **5** is a flowchart illustrating a control algorithm to maintain a surface temperature of a door of a clothing dryer according to an embodiment; and

FIG. **6** is a flowchart illustrating a control algorithm to detect incorrect or broken wiring of a compressor of a clothing dryer according to an embodiment.

DETAILED DESCRIPTION

Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

FIG. **1** is a cross-sectional view showing the configuration of a clothing dryer according to an embodiment.

In FIG. **1**, the clothing dryer **1** according to an embodiment includes a body **10** formed approximately in a hexahedral shape, a drum **20** rotatably installed in the body **10** and provided with a space in which objects to be dried such as clothes are dried, a driving unit **30** to drive the drum **20**, and a drying unit **40** to supply hot air to the drum **20**.

The body **10** may include a cabinet **11**, a top cover **12** to cover the upper portion of the cabinet **11**, and a front panel **13** disposed on the front surface of the cabinet **11**.

An inlet **15** is formed on the front surface of the body **10** to allow an object to be dried to be put into the drum **20** therethrough. A door **16** is hinged to the front of the inlet **15** to open and close the inlet **15**.

The drum **20** is rotatably installed in the body **10**. A plurality of lifters **21** is disposed inside the drum **20** along a circumferential direction of the drum **20**. The lifters **21** repeatedly lift and then drop an object to be dried such that the object is effectively dried.

The front surface of the drum **20** is provided with an opening, and the rear surface of the drum **20** is provided with a hot air inlet **22**. The air heated by a dehumidification unit **80** is introduced into the drum **29** through the hot air inlet **22**.

The drum **20** is driven by the driving unit **30**. The driving unit **30** may include a motor **31** mounted to a base assembly **70**, a pulley **32** to receive power from the motor **31** to rotate, and a belt **33** to connect the pulley **32** and the drum **20** to transfer the power of the motor **31** to the drum **20**. The belt **33** is installed wound around the outer surface of the drum **20** and the pulley **32** coupled to the shaft of the motor **31**.

The drying unit **40** heats air and circulates the heated air to dry an object to be dried in the drum **20**. The drying unit **40** may include an inflow channel **41**, a discharge channel **42**, a fan **43**, and a dehumidification unit **50**.

The inflow channel **41**, disposed at the back of the drum **20**, is adapted to communicate with the inside of the drum **20** through the hot air inlet **22** formed at the drum **20**.

The fan **43** is disposed inside the inflow channel **41**. The fan **43** suctions in hot and dry air which has passed the dehumidification unit **50** and discharges the same into the inflow channel **41**, generating a circulating stream passing through the drum **20**. The fan **43** may be driven together with the drum **20** by the motor **31**.

The discharge channel **42** is disposed at the front of the drum **20** to guide discharge of hot and humid air that has passed through the drum **20**. Installed in the discharge channel **42** is a filter member **42***a* to filter out foreign substances such as dust and naps contained in the air discharged from the drum **20**.

Meanwhile, a dryness sensor **90** is installed at the lower end of the front surface of the drum **20** which communicates with the discharge channel **42**. The dryness sensor **90** contacts an object to be dried which rotates according to rotation of the drum **20** and measures a sensor value of an electrical signal which varies depending on the amount of moisture contained in the object to be dried, thereby determining a degree of dryness of the object. A plate bar type touch sensor is used as the dryness sensor **90**.

In addition, a first temperature sensor **92** to detect the temperature of the air in the drum **20**, which dries the object to be dried and is discharged from the drum **20**, is installed at the discharge channel **42**. The first temperature sensor **92** may be configured with a thermistor whose resistance varies with temperature.

FIG. **2** is a detailed view showing the structure of the base of the clothing dryer according to an embodiment.

In FIG. **2**, a base **70** is installed at the lower portion of the drum **20**. The base **70** is provided with a base body **71** forming the external appearance of the base **70**. The fan **43** is mounted to the back of the base body **71**. In addition, a rear body **72** provided with a bucket **80**, which will be described later, may be mounted to the back of the base body **71**.

The dehumidification unit **50**, the driving unit **30** and the fan **43** may be mounted to the base **70**. Specifically, the dehumidification unit **50** and the driving unit **30** may be mounted to the base body **71**, and the fan **43** may be mounted to the rear body **72**.

A part of the discharge channel **42** may be formed at the portion of the rear body **72** to which the fan **43** is mounted.

A rear cover **73** to protect the bucket **80** may be separately coupled to the portion of the rear body **72** at which the bucket **80** is formed.

Although not shown in FIG. **2**, a base cover (not shown) may be coupled to the upper portion of the base body **71** to cover the dehumidification unit **50** and the driving unit **30**.

The dehumidification unit **50** may include an evaporator **51**, a condenser **52** and a compressor **53**. Although not shown in FIG. **2**, the dehumidification unit **50** may further include an expansion valve.

The evaporator **51**, the condenser **52** and the compressor **53** of the dehumidification unit **50** are connected by pipes through which a refrigerant passes. Installed at a pipe at the outlet of the compressor **53** is a second temperature sensor **94** to detect the temperature of the refrigerant discharged from the compressor **53**, i.e., the temperature of the pipe. The second temperature sensor **94** may be configured with a thermistor whose resistance varies with temperature.

The hot and humid air discharged from the drum **20** (see FIG. **1**) flows into the dehumidification unit **50**. The hot and humid air introduced into the dehumidification unit **50** then passes through the evaporator **51**, through which the refrigerant passes. The refrigerant expands in the evaporator **51** due to pressure drop, thereby absorbing heat. While the refrigerant evaporates and absorbs heat in the evaporator **51**, the hot and humid air cools down, losing moisture in the process, and turns into cold and dry air. That is, the hot and humid air discharged from the drum **20** turns into cold and dry air while passing through the evaporator **51**.

The cold and dry air having passed through the evaporator **51** subsequently passes through the condenser **52**. The refrigerant overheated by being compressed by the compressor **53** passes through the condenser **52**. While passing through the condenser **52**, the overheated refrigerant dissipates heat. On the other hand, the cold and dry air is heated into hot and dry air. That is, the cold and dry air discharged from the evaporator **51** turns into a hot and dry air while passing through the condenser **52**.

Thereafter, the hot and dry air having passed through the condenser **52** is guided along a guide channel **54** into the inflow channel **41**. The hot and dry air guided into the inflow channel **41** is caused to flow along the inflow channel **41** toward the drum **20** by the fan **43**.

When the drying operation begins, the motor **31** and the compressor **53** are driven. The fan **43** is rotated by the motor **31** to generate air flow, and the compressor **53** compresses the refrigerant at high temperature and high pressure to circulate the refrigerant. The refrigerant compressed at high temperature and high pressure by the compressor **53** passes through the condenser **52** and the evaporator **51**, and is then suctioned into the compressor **53**, thus forming a refrigerant cycle. During this process, the air turns into hot and dry air while passing through the evaporator **51** and the condenser **52**, and is then introduced into the drum **20**. The hot and dry air introduced into the drum **20** removes moisture from the object to be dried which has been put into the drum **20** to dry the object. In the process, the air turns into hot and humid air. The hot and humid air flows along the discharge channel **42** and enters the dehumidification unit **50** where it is turned into hot and dry air. The hot and dry air in turn flows into the drum **20**.

When moisture is separated by cooling of the hot and humid air discharged from the drum **20** in the evaporator **51**, condensed water is produced. The condensed water is collected in a bucket **80** mounted to the base **70**.

In addition, the power of the motor **31** is transferred to the drum **33** via the belt **33** to rotate the drum **20**. Thereby, the object to be dried is uniformly dried while being moved.

FIG. **3** is a control block diagram illustrating the clothing dryer according to an embodiment.

In FIG. **3**, the clothing dryer **1** of an embodiment includes a dryness sensor **90**, a first temperature sensor **92**, a second temperature sensor **94**, an input unit **100**, a controller **102**, a memory **104**, a driving unit **106**, a display unit **108**, and an alarm unit **110**.

The dryness sensor **90** detects a degree of dryness of an object to be dried using a pulse signal generated when it contacts the object, and then transmits the detected degree of dryness to the controller **102**.

The first temperature sensor **92** detects the temperature of the air in the drum **20** accommodating the object to be dried, i.e., the temperature at the outlet of the drum **20**, and transmits the detected temperature to the controller **102**.

The second temperature sensor **94** detects the temperature of the refrigerant discharged from the compressor **53**, i.e., the temperature of the pipe connected to the outlet of the compressor **53**, and transmits the detected temperature to the controller **102**.

The input unit **100** is used to input, to the controller **102**, operational information, selected by a user, which involves a drying course (for example, a normal drying course, a towel-drying course, a permanent press drying course and a delicate drying course), drying time and an operational command. The input unit **100** may be configured with various buttons disposed on a control panel.

In addition to the above buttons, the input unit **100** may be provided with a jog dial to allow selection of a type of drying (for example, semi-drying and complete drying). The input unit **100** may be separately provided with an adjustment button to adjust the operation factor of the selected drying course and the selected drying time.

In addition, the input unit **100** may be configured with a key, a switch, a touch pad, and any other components which generate predetermined input data by being pushed, touched, pressed or turned.

The controller **102** is a microcomputer which controls overall operations of the clothing dryer **1** according to operational information input through the input unit **100**. Depending on the degree of dryness of the object to be dried, as determined by the dryness sensor **90**, the controller **102** subdivides the drying course to control the drying operation.

In addition, the controller **102** determines breaking of the belt **33** using the dryness sensor **90** at the beginning of the drying operation or during the drying operation. In the case that the change in the sensor value (the mean absolute deviation of pulse signals) detected by the dryness sensor **90** at the beginning of the drying operation or during the drying operation is kept equal to or less than, for example, 5 (a reference value of the absolute deviations to determine breakage of the belt **33**) until a second time (about 10 minutes, a reference time taken to accumulate deviations of the pulse values to determine breakage of the belt **33**) elapses, the controller **102** determines that the belt **33** is broken. Accordingly, the controller **102** stops the motor **31** and the compressor **53** and reports abnormal state of the belt **33** by sounding an alarm or displaying a message.

In addition, the controller **102** maintains a proper surface temperature of the door **16** using the first temperature sensor **92** during the drying operation. While the drying operation is proceeding, the first temperature sensor **92** detects the temperature of the air in the drum **20** accommodating the object to be dried, i.e., the temperature at the outlet of the drum **20**. In the case that the detected temperature is equal to or greater than a determined first reference temperature (the minimum temperature which may cause a burn due to the hot surface temperature of the door **16** (about 60° C.)), the controller **102** stops the compressor **53**. In the case that the temperature at the outlet of the drum **20** is equal to or less than a determined second reference temperature (the maximum temperature making the objects to be dried cold enough to result in a lower drying efficiency, about 50° C.), the controller **102** drives the compressor **53** to keep the inside of the drum **20** at a proper temperature to control the surface temperature of the door **16**.

In addition, the controller **102** determines incorrect or broken wiring of the compressor **53** using the second temperature sensor **94** at the beginning of the drying operation. In the case that the change in the sensor values detected by the second temperature sensor **94** within a third time (the maximum amount of time needed to detect incorrect or broken wiring of the compressor **53**, about 10 minutes) immediately after the beginning of the drying operation, i.e., the change in temperature of the pipe (ΔT) is equal to or greater than a reference change (ΔTs, the change in pipe temperature due to incorrect or broken wiring of the compressor **53**, which is about 50° C.), the controller **102** determining that there is incorrect or broken wiring of the compressor **53**. Accordingly, the controller **102** stops the motor **31** and the compressor **53** and reports incorrect or broken wiring of the compressor **53** by sounding an alarm or displaying a message.

The memory **104** may store reference data used during control of the operation of the clothing dryer **1**, operation data produced while the clothing dryer **1** performs the drying operation, setting information such as setting date input through the input unit **100** to cause the clothing dryer **1** to perform the drying operation, the number of times the clothing dryer **1** has performed a specific operation, user information including model information about the clothing dryer **1**, and malfunction information including causes of malfunction or position of the malfunctioning part of the clothing dryer **1**.

The driving unit **106** drives the motor **31** and the compressor **53** which are related to operations of the clothing dryer **1** according to a driving control signal from the controller **102**.

The display unit **108** displays the operational state of the clothing dryer **1** according to a display control signal from the controller **102**. In addition, the display unit **108** displays user touch manipulation by recognizing the touch information input through the user interface by the user.

In the case that the display unit **108** is a liquid crystal display user interface (LCD UI) capable of displaying a text message, breakage of the belt **33** or incorrect or broken wiring of the compressor **53** is displayed as a text message to allow the user to take proper actions.

In addition, when a light emitting diode user interface (LED UI) is used as the display unit **108**, the LED UI allows the user to recognize the abnormal state of the clothing dryer **1** by lighting or flickering, or by using different durations of lighting.

The alarm unit **110** sounds an alarm or a voice according to an alarm control signal from the controller **102** when breakage of the belt **33** or incorrect or broken wiring of the compressor **53** is detected, allowing the user to recognize the abnormal state of the clothing dryer **1**.

Hereinafter, a description will be given of procedures and effects of operation of a clothing dryer and a control method thereof according to an embodiment.

Detection of breakage of the belt **33** at the beginning of or during the drying operation will first be described with reference to FIG. **4**.

FIG. **4** is a flowchart showing a control algorithm to detect breakage of a belt in a clothing dryer according to an embodiment.

In FIG. **4**, once the user puts objects to be dried into the drum **20** and selects one of the drying courses (including a normal-drying course, a towel-drying course, a perm-drying course and a delicate-drying course) according to the type of the objects to be dried (**200**), the information on the course (operation) selected by the user is input to the controller **102** through the input unit **100**.

Then, the controller **102** determines whether an operational command has been input, to begin the drying operation according to the information on the drying course input through the input unit **100** (**202**).

When it is determined that an operational command has been input in operation **202**, the controller **102** drives the motor **31** and the compressor **53** through the driving unit **106** to perform the drying operation (**204**).

When the drying operation begins, air begins to flow into the clothing dryer **1** according to rotation of the fan **43** by operation of the motor **31**, and the power of the motor **31** is transferred to the drum **20** via the belt **33**. Thereby, the drum **20** rotates according to the transferred power, rotating the objects to be dried in the drum **20**.

At this time, the compressor **53** compresses and discharges the refrigerant at high temperature and high pressure to heat the air moving in the clothing dryer **1**. The refrigerant compressed at high temperature and high pressure by the compressor **53** releases heat, forming a refrigeration cycle by passing through the condenser **52** and the evaporator **51** and then being suctioned into the compressor **53**.

Accordingly, the air flowing in the clothing dryer **1** turns into hot and dry air as it passes through the condenser **52** of the dehumidification unit **50**. Then, the hot and dry air is guided into the inflow channel **41** along the guide channel **54**. The hot and dry air (hot air) guided into the inflow channel **41** is caused to flow along the inflow channel **41** and enter the drum **20** through the hot air inlet **22**, by rotation of the fan **43**. The hot and dry air (hot air) introduced into the drum **20** contacts the objects to be dried which are repeatedly lifted and dropped by being rotated in the drum **20**, drying the objects by evaporating the moisture contained in the objects.

As the drying operation begins as above, the objects to be dried in the drum **20** start to become dry. The change in the degree of dryness of the objects to be dried which occurs during the drying operation is detected and input into the controller **102** by the dryness sensor **90** (**206**).

At this time, the dryness sensor **90** outputs pulse values by converting the degree of dryness of the objects to be dried obtained by contacting the objects into electrical signals.

In the case that the belt **33** to transfer power of the motor **31** to the drum **20** is broken or displaced, the drum **20** does not normally rotate but stops. In this case, the hot and dry air (hot air) is intensively supplied to the objects accumulated near the hot air inlet **22** allowing the hot air to enter the drum **20**. Thereby, the hot air is hardly supplied to the objects placed at the position opposite the hot air inlet **22**.

Thereby, the change of pulse values detected by the dryness sensor **90** is kept equal to or less than a certain value. This is because the dryness sensor **90** is installed at the discharge channel **42** which is located at the position opposite the hot air inlet **22**.

Accordingly, the controller **102** determines whether a first time (first time period) (about 20 minutes, the drying time for determination of breakage of the belt) has elapsed since the beginning of the drying operation (**208**). In the case that the first time has not elapsed since the beginning of the drying operation, the controller **102** returns to operation **206** and converts the degree of dryness of the objects to be dried into electrical signals using the dryness sensor **90** to output pulse values.

When it is determined that the first time (first time period) has elapsed since the beginning of the drying operation in operation **208**, the controller **102** calculates the mean absolute deviation of pulse values that have been cumulated for a second time (second time period) (about 10 minutes, a reference time needed to cumulate deviations of pulse values to determine breakage of the belt **33**) before the first time elapses (**210**). Herein, the mean absolute deviation refers to a value obtained by averaging the absolute deviations of the pulse values detected by the dryness sensor **90** which have been accumulated for a specific time (the second time).

Then, the controller **102** compares the average value calculated at the beginning of the drying operation with a set value (for example, 5, a reference value of the absolute deviations to determine breakage of the belt **33**) (**212**). In the case that the average value is equal to or less than the set value, the controller **102** stops the motor **31** and the compressor **53** through the driving unit **106** and terminates the drying operation, determining that the belt **33** has been broken at the beginning of the drying operation (**214**).

Then, the controller **102** displays breakage of the belt through the display unit **108** and sounds an alarm or a voice through the alarm unit **110** such that the user recognizes breakage of the belt **33** (**216**).

When it is determined that the average value calculated at the beginning of the drying operation is greater than the set value in operation **212**, the controller **102** controls operation of the motor **31** and the compressor **53** through the driving unit **106** to continue the drying operation, determining that the belt **33** is in a normal state at the beginning of the drying operation (**218**).

Breakage of the belt **33** may occur during the drying operation. Accordingly, the controller **102** continues to calculate the mean absolute deviation of pulse values that have been cumulated for the second time (about 10 minutes, a reference time needed to determine breakage of the belt **33**) while the drying operation is proceeding (**220**).

Then, the controller **102** compares the average value calculated during the drying operation with a set value (for example, 5, a reference value of the absolute deviations to determine breakage of the belt **33**) (**222**). In the case that the average value is equal to or less than the set value, the controller **102** proceeds to operation **214** and stops the motor **31** and the compressor **53**, determining that the belt **33** has been broken during the drying operation.

Subsequently, the controller **102** indicates breakage of the belt through the display unit **108** and sounds an alarm or a voice through the alarm unit **110** such that the user may recognize breakage of the belt **33**.

When it is determined that the average value calculated during the drying operation is greater than the set value in operation **222**, the controller **102** drives the motor **31** and the compressor **53** through the driving unit **106** to continue the drying operation, determining that the belt **33** is in a normal state during the drying operation.

The change rate of the degree of dryness of the objects to be dried decreases during the drying operation as above. The dryness sensor **90** determines the degree of dryness detected by contacting the objects rotating in the drum **20** and inputs the determined degree of dryness to the controller **102** (**224**).

Thereby, the controller **102** determines whether the degree of dryness determined by the dryness sensor **90** has reached the target degree of dryness (the degree of dryness at which the controller **102** determines that drying of the objects has been completed) (**226**). In the case that the target degree of dryness has not been reached, the controller **102** returns to operation **218** to detect breakage of the belt **33** and performs the drying operation.

When it is determined that the target degree of dryness has been reached in operation **226**, the controller **102** stops driving the motor **31** and the compressor **53** through the driving unit **106** and terminates all drying operations (**228**).

In an embodiment, the dryness sensor **90** is used to detect breakage of the belt **33**. However, embodiments are not limited thereto. The first temperature sensor **92** to detect the temperature of the air in the drum **20**, i.e., the temperature at the outlet of the drum **20** may be used to detect breakage of the belt **33**.

In the case that the belt **33** is broken or displaced, the drum **20** does not normally rotate but stops. Thereby, the hot and dry air (hot air) flowing into the drum **20** is not uniformly distributed to the inside of the drum **20**, but is intensively supplied in only one direction (specifically, the direction in which the air introduced through the hot air inlet **22** travels). In this case, the hot and dry air (hot air) is also intensively supplied to the door **16**, which is the direction in which the air introduced through the hot air inlet **22** travels. Thereby, the surface temperature of the door **16** may increase.

Accordingly, the first temperature sensor **92** detects the temperature at the outlet of the drum **20**, which allows estimation of the surface temperature of the door **16** for a certain time and calculates the change in the temperature at the outlet of the drum **20**. In the case that the calculated change in the temperature at the outlet of the drum **20** is equal to or greater than a determined change value, it may be determined that the belt **33** is broken.

Using the first temperature sensor **92** to detect the temperature at the outlet of the drum **20** is applicable as an example of various techniques for detection of breakage of the belt **33**.

Next, a description will be given of keeping a proper surface temperature of the door **16** during the drying operation or after completion of the drying operation, with reference to FIG. **5**.

As the drying operation proceeds, the temperature of the air in the drum **20** becomes high. Thereby, the surface temperature of the door **16** also increases. The increased surface temperature of the door **16** may burn the user. Therefore, the surface temperature of the door **16** needs to be controlled not to excessively increase during the drying operation or after completion of the drying operation. However, the surface temperature of the door **16** cannot be unconditionally lowered to protect the user from burns. This is because lowering the temperature of the inside of the drum **20** to lower the surface temperature of the door **16** may cause the objects to feel cold when the user removes the objects after completion of the drying operation, thereby causing the user to consider that drying quality has been degraded, despite actual completion of drying.

Accordingly, to prevent injury to the user and occurrence of lower temperature of the objects after drying and to provide a drying quality with which the user may be satisfied, a proper surface temperature of the door **16** needs to be maintained.

FIG. **5** is a flowchart illustrating a control algorithm to maintain the surface temperature of a door of a clothing dryer according to an embodiment.

In FIG. **5**, once the user puts objects to be dried into the drum **20** and selects one of the drying courses (including a normal-drying course, a towel-drying course, a perm-drying course and a delicate-drying course) according to the type of the objects to be dried (**300**), the information on the course selected by the user is input to the controller **102** through the input unit **100**.

Then, the controller **102** determines whether an operation command has been input, to begin the drying operation according to the information on the drying course input through the input unit **100** (**302**).

When it is determined that an operation command has been input in operation **302**, the controller **102** drives the motor **31** and the compressor **53** through the driving unit **106** to perform the drying operation (**304**).

When the drying operation begins, air begins to flow in the clothing dryer **1** according to rotation of the fan **43** by operation of the motor **31**, and the power of the motor **31** is transferred to the drum **20** via the belt **33**. Thereby, the drum **20** rotates according to the transferred power, rotating the objects to be dried in the drum **20**.

At this time, the compressor **53** compresses and discharges the refrigerant at high temperature and high pressure to heat the air moving in the clothing dryer **1**. The refrigerant compressed at high temperature and high pressure by the compressor **53** releases heat, forming a refrigeration cycle by passing through the condenser **52** and the evaporator **51** and then being suctioned into the compressor **53**.

Accordingly, the air flowing in the clothing dryer **1** turns into hot and dry air as it passes through the condenser **52** of the dehumidification unit **50**. Then, the hot and dry air is guided into the inflow channel **41** along the guide channel **54**. The hot and dry air (hot air) guided into the inflow channel **41** is caused to flow along the inflow channel **41** and enter the drum **20** through the hot air inlet **22**, by rotation of the fan **43**. The hot and dry air (hot air) introduced into the drum **20** contacts the objects to be dried which are repeatedly lifted and dropped by being rotated in the drum **20**, drying the objects by evaporating the moisture contained in the objects.

When the drying operation proceeds according to operation of the motor **31** and compressor **53**, the air temperature in the drum **20** increases to a higher level. Thereby, the surface temperature of the door **16** also increases.

Accordingly, the first temperature sensor **92** installed at the side of the discharge channel **42** detects the air temperature in the drum **20** which increases during the drying operation, i.e., the temperature at the outlet of the drum **20**, and inputs the detected temperature to the controller **102** (**306**).

Thereby, the controller **102** determines whether the temperature at the outlet of the drum **20** detected by the first temperature sensor **92** is equal to or greater than a determined first reference temperature (the minimum temperature which may cause a burn due to the hot surface temperature of the door **16**, about 60° C.) (**308**).

When it is determined, in operation **308**, that the temperature at the outlet of the drum **20** is not equal to or greater than the first reference temperature, the controller **102** returns to operation **306** and performs subsequent operations.

When it is determined, in operation **308**, that the temperature at the outlet of the drum **20** is equal to or greater than the first reference temperature, the controller **102** stops the compressor **53** through the driving unit **106** (**310**). Once the compressor **53** is stopped, heating of the air flowing in the clothing dryer **1** is stopped. Therefore, the air temperature in the drum **20** is lowered, and thereby the surface temperature of the door **16** is also lowered.

Even when the compressor **53** is stopped, the motor **31** operates to continue rotating the drum **20** and the fan **43**.

Thereafter, the first temperature sensor **92** detects the air temperature in the drum **20** which is lowered according to stopping of the compressor **53**, and inputs the detected temperature to the controller **102** (**312**).

Accordingly, the controller **102** determines whether the temperature at the outlet of the drum **20** detected by the first temperature sensor **92** is equal to or less than a determined second reference temperature (the maximum temperature which makes the objects to be dried cold enough to result in a lower drying efficiency, about 50° C.) (**314**).

When it is determined, in operation **314**, that the temperature at the outlet of the drum **20** is not equal to or less than the second reference temperature, the controller **102** returns to operation **312** and performs subsequent operations.

When it is determined, in operation **314**, that the temperature at the outlet of the drum **20** is equal to or less than the second reference temperature, the controller **102** drives the compressor **53** through the driving unit **106** again (**316**). When the compressor **53** is driven, heating of the air flowing in the clothing dryer **1** resumes and the air temperature in the drum **20** increases. Thereby, the surface temperature of the door **16** also increases.

By driving or stopping the compressor **53** according to the temperature at the outlet of the drum **20** as above, the surface temperature of the door **16** may be properly maintained between the first reference temperature (60° C.) and the second reference temperature (50° C.). However, the temperature at the outlet of the drum **20** differs from the surface temperature of the door **16** by about 5° C. Therefore, the surface temperature of the door **16** is maintained between about 55° C. and about 45° C., in reality.

Since the drying operation is continued while the surface temperature of the door **16** is properly maintained, the change rate of the degree of dryness of the objects to be dried decreases. Therefore, the dryness sensor **90** determines the degree of dryness of the objects to be dried rotating in drum **20**, which is detected when the dryness sensor **90** contacts the objects, and inputs the determined degree of dryness to the controller **102** (**318**).

Accordingly, the controller **102** determines whether the degree of dryness determined by the dryness sensor **90** has reached the target degree of dryness (the degree of dryness at which the controller **102** determines that drying the objects has been completed) (**320**). In the case that the target degree of dryness has not been reached, the controller **102** returns to operation **306** to maintain a proper surface temperature of the door **16** and perform the drying operation.

When it is determined, in operation **320**, that the target degree of dryness has been reached, the controller **102** stops driving the motor **31** and the compressor **53** through the driving unit **106** and terminates all drying operations (**322**).

Next, a description will be given of detecting incorrect or broken wiring of the compressor **53** at the beginning of the drying operation, with reference to FIG. **6**.

In the case that the terminals of the compressor **53** are incorrectly connected, the compressor **53** may be overloaded. In the worst case, the terminals of the compressor **53** may explode, resulting in loud noise and sparks. Further, the refrigerant may leak, causing harm to the user. Therefore, when the terminals of the compressor **53** are incorrectly connected, the compressor **53** and the clothing dryer **1** need to be stopped before the terminals of the compressor **53** explode, in order to remove the danger that may be caused by explosion. In an embodiment, such incorrect or broken wiring of the compressor **53** may be detected at the beginning of the drying operation.

FIG. **6** is a flowchart illustrating a control algorithm to detect incorrect or broken wiring of a compressor of a clothing dryer according to an embodiment.

In FIG. **6**, once the user puts objects to be dried into the drum **20** and selects one of the drying courses (including a normal-drying course, a towel-drying course, a perm-drying course and a delicate-drying course) according to the type of the objects to be dried (**400**), the information on the course selected by the user is input to the controller **102** through the input unit **100**.

Then, the controller **102** determines whether an operation command has been input, to begin the drying operation according to the information on the drying course input through the input unit **100** (**402**).

When it is determined, in operation **402**, that an operation command has been input, the controller **102** drives the motor **31** and the compressor **53** through the driving unit **106** to begin the drying operation (**404**).

When the drying operation begins, air begins to flow in the clothing dryer **1** according to rotation of the fan **43** by operation of the motor **31**, and the power of the motor **31** is transferred to the drum **20** via the belt **33**. Thereby, the drum **20** rotates according to the transferred power, rotating the object to be dried in the drum **20**.

At this time, the compressor **53** compresses and discharges the refrigerant at high temperature and high pressure to heat the air moving in the clothing dryer **1**. The refrigerant compressed at high temperature and high pressure by the compressor **53** releases heat, forming a refrigeration cycle by passing through the condenser **52** and the evaporator **51** and then being suctioned into the compressor **53**.

Accordingly, the air flowing in the clothing dryer **1** turns into hot and dry air as it passes through the condenser **52** of the dehumidification unit **50**. Then, the hot and dry air is guided into the inflow channel **41** along the guide channel **54**. The hot and dry air (hot air) guided into the inflow channel **41** is caused to flow along the inflow channel **41** and enter the drum **20** through the hot air inlet **22**, by rotation of the fan **43**. The hot and dry air (hot air) introduced into the drum **20** contacts the objects to be dried which are repeatedly lifted and dropped by being rotated in the drum **20**, drying the objects by evaporating the moisture contained in the objects.

When the drying operation proceeds according to operation of the motor **31** and compressor **53**, the temperature of the pipe connected to the discharge side of the compressor **53** begins to rise due to the temperature of the refrigerant discharged from the compressor **53**. In the case of incorrect or broken wiring of the compressor **53**, the temperature of the pipe of the compressor **53** drastically rises.

Accordingly, the second temperature sensor **94** installed at the discharge side of the compressor **53** detects the initial pipe temperature T**1** of the compressor **53** at the beginning of the drying operation and inputs the detected temperature to the controller **102** (**406**).

Then, the controller **102** determines whether a third time (the maximum amount of time needed to detect incorrect or broken wiring of the compressor **53**, about 10 minutes) has elapsed since the beginning of the drying operation (**408**). In the case that the terminals of the compressor **53** are incorrectly connected, the temperature of the pipe of the compressor **53** drastically rises. Therefore, the change in the temperature of the pipe due to incorrect or broken wiring of the compressor **53** is detected within the third time after the drying operation begins.

When it is determined, in operation **408**, that the third time has not elapsed since the beginning of the drying operation, the second temperature sensor **94** continues to detect a pipe temperature T**2** of the pipe of the compressor **53**, and inputs the detected pipe temperature T**2** to the controller **102** (**410**).

Accordingly, the controller **102** calculates the change in pipe temperature ($\Delta T = T2 - T1$) using the pipe temperature T**2** detected by the second temperature sensor **94** and the initial pipe temperature T**1** detected at the beginning of the drying operation (**412**).

Then, the controller **102** compares the calculated change in pipe temperature (ΔT) with a reference temperature change (ΔTs, the change in pipe temperature due to incorrect or broken wiring of the compressor **53**, which is about 50° C.), and determines whether the change in pipe temperature (ΔT) is equal to or greater than the reference temperature change (ΔTs) (**414**).

When it is determined, in operation **414**, that the change in pipe temperature (ΔT) is not equal to or greater than the reference temperature change (ΔTs), the controller **102** returns to operation **408** and performs subsequent operations.

Meanwhile, when it is determined, in operation **414**, that the change in pipe temperature (ΔT) is equal to or greater than the reference temperature change (ΔTs), the controller **102** stops the motor **31** and the compressor **53** through the driving unit **106** and terminates the drying operation, determining that incorrect or broken wiring of the compressor **53** has occurred at the beginning of the drying operation (**416**).

Then, the controller **102** displays incorrect or broken wiring of the compressor **53** through the display unit **108** and sounds an alarm or a voice through the alarm unit **110** such that the user recognizes incorrect or broken wiring of the compressor **53** (**418**).

In addition, when it is determined, in operation **408**, that the third time has elapsed since the beginning of the drying operation, the controller **102** controls operation of the motor **31** and the compressor **53** through the driving unit **106** to continue the drying operation since rise in pipe temperature due to incorrect or broken wiring of the compressor **53** has been detected. In the case that there is incorrect or broken wiring of the compressor **53**, the change in pipe temperature (ΔT) is allowed to reach the reference temperature change (ΔTs) within the third time after the beginning of the drying operation since the pipe temperature of the compressor **53** drastically rises after the compressor **53** is operated. Therefore, when the third time elapses, the controller **102** does not detect the pipe temperature of the compressor **53** anymore and performs the drying operation, determining that wiring of the compressor **53** is normal.

The degree of dryness of the objects to be dried begins to decrease according to the drying operation as above. The dryness sensor **90** determines the degree of dryness of the objects to be dried rotating in drum **20**, which is detected when the dryness sensor **90** contacts the objects, and inputs the determined degree of dryness to the controller **102** (**420**).

Accordingly, the controller **102** determines whether the degree of dryness determined by the dryness sensor **90** has reached the target degree of dryness (the degree of dryness with which the controller **102** determines that drying the objects has been completed) (**422**). In the case that the target degree of dryness has not been reached, the controller **102** returns to operation **420** and performs subsequent operations.

When it is determined, in operation **422**, that the target degree of dryness has been reached, the controller **102** stops driving the motor **31** and the compressor **53** through the driving unit **106** and terminates all drying operations (**424**).

As is apparent from the above description, according to a clothing dryer and a control method thereof as proposed, a conventional dryness sensor may be used, without installation of a separate component, to determine breakage of a belt. When a sensor value is kept equal to or less than a specific value without undergoing variation for a specific time, it is determined that the belt is broken, and the motor is stopped together with report of abnormality of the belt through an alarm or a visible indication. Thereby, cost may be reduced, and a proper action may be taken.

In addition, according to a clothing dryer and a control method thereof as proposed, a conventional temperature sensor may be used to maintain a proper surface temperature of a door of the clothing dryer, without installation of a separate component. Thereby, harm to a user due to rise in the surface temperature of the door may be prevented. Moreover, degradation of drying quality resulting from decease in temperature of objects to be dried may also be prevented.

Furthermore, the pipe temperature of a compressor adapted to compress a refrigerant to produce hot air to be supplied into a drum is detected. Thereby, in the case that the pipe temperature increases beyond a specific temperature, it is determined that incorrect or broken wiring of the compressor has occurred, and the compressor is stopped together with report of abnormality of the belt through an alarm or a visible indication. Thereby, the product may be protected and a proper action may be taken.

Although a few embodiments have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A control method of a clothing dryer provided with a drum to accommodate an object to be dried, a motor to generate power to rotate the drum, and a belt to transfer the power of the motor to the drum, the control method comprising:

rotating the drum according to operation of the motor to dry the object;

detecting a degree of dryness of the object for a specific time and calculating change in the degree of dryness;

converting the degree of dryness to pulse values, and accumulating deviations of the pulse values for the specific time;

determining that the belt is abnormal if a mean absolute deviation of the accumulated pulse values is equal to or less than a set value, the abnormality being that the belt is either broken or displaced; and

stopping the motor when determining that the belt is abnormal.

2. The control method according to claim **1**, wherein:

a first time period begins at the beginning of the drying operation;

the specific time is a second time period during the drying operation before the first time period elapses, and

the second time period is shorter than the first time period.

3. The control method according to claim **1**, wherein the specific time is a time period since beginning of the change in the degree of dryness during a drying operation.

4. The control method according to claim **2**, wherein the first time is about 20 minutes.

5. The control method according to claim **2**, wherein the second time is about 10 minutes.

6. The control method according to claim **1**, further comprising stopping the motor and at the same time stopping a compressor to compress a refrigerant to heat air flowing into the drum, when determining that the belt is abnormal.

7. The control method according to claim **1**, further comprising,

reporting that the belt is abnormal through an alarm or a visible indication, when determining that the belt is abnormal.

8. A clothing dryer comprising:

a drum to accommodate an object to be dried;

a motor to generate power to rotate the drum;

a belt to transfer the power of the motor to the drum;

a dryness sensor to detect a degree of dryness of the object, and output pulse values that correspond to the degree of dryness of the object; and

a controller to detect change in sensor values of the dryness sensor for a specific time to determine whether the belt is abnormal, the abnormality being that the belt is either broken or displaced,

wherein the controller is arranged to accumulate deviations of the pulse values input through the dryness sensor for the specific time, and to determine that the belt is abnormal when a mean absolute deviation of the accumulated pulse values is equal to or less than a set value.

9. The clothing dryer according to claim **8**, wherein the degree of dryness is converted into an electrical signal.

10. The clothing dryer according to claim **8**, wherein the controller stops the motor when the controller determines that the belt is abnormal.

11. The clothing dryer according to claim **10**, wherein, when the controller determines that the belt is abnormal, the controller stops the motor and at the same time stops a compressor to compress a refrigerant to heat air flowing into the drum.

12. The clothing dryer according to claim **10**, further comprising a display unit to display abnormality of the belt or an alarm unit to produce an alarm sound or a buzzer sound, in order to report that the belt is abnormal.

13. A control method of a clothing dryer provided with a door and a drum to accommodate an object to be dried, a motor to rotate the drum, and a compressor to compress a refrigerant to heat air flowing into the drum, the control method comprising:

performing a drying operation by driving the motor and the compressor;

detecting a temperature of air discharged from the drum using a temperature sensor during the drying operation; and

comparing the detected temperature at the outlet of the drum with a predetermined reference temperature, and controlling operation of the compressor according to a result of the comparison to keep a surface temperature of the door constant.

14. The control method according to claim **13**, wherein the temperature sensor is a thermistor.

15. The control method according to claim **14**, wherein the thermistor is installed in a discharge channel allowing the air having passed through the drum to be discharged therethrough.

16. The control method according to claim **13**, wherein the controlling of the operation of the compressor comprises:

stopping the compressor when the temperature of the discharged air of the drum is equal to or higher than a first reference temperature; and

driving the compressor when the temperature of the discharged air of the drum is equal to or higher than a second reference temperature.

17. The control method according to claim **16**, wherein the motor is driven regardless of whether or not the compressor is stopped.

18. The control method according to claim **3**, wherein the time is about 10 minutes.

19. A control method of a clothing dryer provided with a door and a drum to accommodate an object to be dried, a motor to rotate the drum, and a compressor to compress and discharge a refrigerant through a pipe to heat air flowing into the drum, the control method comprising:

performing a drying operation by driving the motor and the compressor;

detecting an initial pipe temperature of the pipe using a temperature sensor installed at a discharge side of the compressor at the beginning of the drying operation;

determining whether a predetermined time has elapsed during the drying operation;

detecting a current pipe temperature after the predetermined time has elapsed and calculating a difference between the initial pipe temperature and the current pipe temperature; and

controlling operation of the motor and compressor according to a result of the calculated difference to protect the clothing dryer from damage due to broken wiring or incorrect wiring of the clothing dryer causing a heat surge and informing the user according to the result by a sound or a visual display.

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